WorldSpace Radio (2)

worldwide satellite radio receivers

by G Kleine

A low-cost chipset has been developed for the WorldSpace digital satellite radio system described in the previous instalment of this series. The chipset is already in use in WorldSpace receivers. In this second and final part we will describe several of these receivers, their functions and antennas, and look at the stations that can be received.

In order to ensure the development of low-cost receivers, WorldSpace has commissioned ST Microelectronics and Micronas to produce a million chipsets. The so-called **Starman chipset** consists of the devices whose part numbers and functions are shown in **Table 1**.

Receivers

The first manufacturers of receivers were the well-known Japanese companies Hitachi, Panasonic, Sanyo and JVC. These companies had an exclusive agreement with World-Space Corporation until 2001. More recently, other manufacturers have come to the fore, and now 18 companies have signed licence agreements with WorldSpace. Most of the units are portable radios with adjustable antennas attached, and sport at least a mono loudspeaker. Although some of the receivers (from JVC, BPL and Polytron) have the shape of a ghetto blaster and offer stereo loudspeakers, the majority take the form of compact travel radios. All have a socket for stereo headphones, an LCD, often with several rows of characters, and can run from batteries or from the mains, generally via a small mains adaptor. Some units can also receive FM, medium-wave and/or shortwave and long-wave transmissions.

Programmes can be selected by broadcast channel number, service component, language or programme type (see Table 3 in the first part of this series). Intelligent receivers offer programmes in the same language or of the same type as the selected broadcast channel.

Table 2 shows a small selection of receivers with their characteristics. An overview of known WorldSpace receivers can be downloaded from the *Elektor Electronics* homepage: go to www.elektor-electronics.co.uk, choose the 'Free Downloads' menu, and then select this issue (June 2002) from the downloads index.

It became apparent that at a price of around US$ 100 the customer base was not as great as had been expected in Africa, where the cost of a WorldSpace receiver is equivalent to about two months' salary. In Ghana, Ethiopia, Kenya and South Africa, WorldSpace receivers are available for US$ 125 to US$ 175. Nevertheless, in East Africa alone 40,000 receivers have been sold so far.

In the areas covered by AsiaStar and AmeriStar the units are in relative terms less expensive. There the population can more readily afford the price of a receiver. It is therefore expected that WorldSpace radios will rapidly be taken up in these regions.

Antennas

A flat, or 'patch' antenna, about the size of a CD, is used to receive the WorldSpace signals. Short helical or Yagi antennas can also be used. The acceptance angle of the WorldSpace patch antenna is around 80 degrees, both horizontally and vertically. This is so wide that exact alignment, as required by TV satellite dishes, is unnecessary. The antennas have an RF bandwidth of around 50 MHz.

The patch antenna is usually detachable and can be situated remotely from the receiver, for example on a window, using an antenna cable fitted with F connectors. The antenna includes an integrated amplifier, which receives its power supply from the receiver over the antenna connection. Typical current consumption for a patch

Table 1 The ST Microelectronics and Micronas Starman chipsets

Manufacturer	Part number	Function
ST Micro-electronics	STA 001	Radio Frequency Frontend IC
	STA 002	Channel Decoder
	STA 003	Source Decoder
Micronas Intermetall	DRD 3515 A	Channel Decoder
	MAS 3506 D	Source Decoder

Table 2a. Some WorldSpace receivers employing the Starman chipset

Note: a complete summary can be downloaded from *www.elektor-electronics.co.uk*

Receiver	**KH-WS 1**	**RE-WS 10**	**DSB-WS 1000**
Manufacturer	Hitachi (Japan)	Panasonic (Japan)	Sanyo (Japan)
Memories	10	10	32
Other wavebands	FM, MW, SW	none	none
Loudspeaker	Mono, 0.5 W	Stereo, 2x 3 W	Mono, 0.7 W
Headphones	Stereo	Stereo	Stereo
Display	1 row of 8 characters	3 rows of 12 characters	2 rows of 8 characters
Data port	yes	yes	yes
Special features		2-way loudspeaker	remote control, alarm clock
Power supply	4 D cells	4 D cells	2 D cells plus 2 AA cells
Dimensions	241 x 163 x 65 mm	302 x 300 x 135 mm	260 x 85 x 190 mm
Weight	1.5 kg	3.4 kg	1.1 kg
Accessories			5 m antenna cable
Price (Euros)	€ 180	€ 245	€ 190
Website	www.hitachi.com	www.panasonic.com	www.sanyo.com

antenna is around 70 mA. Also, the level of the supply voltage is used to switch the antenna between right-hand circular polarisation (2.8 V to 3.3 V) and left-hand circular polarisation (2.2 V to 2.5 V).

Antenna cables up to 10 m long can be used without difficulty. If a longer cable run is required between receiver and antenna, a special amplifier can be obtained which is also supplied with power over the antenna connection.

Also available, for around fifty pounds, is a so-called rooftop antenna kit which consists of a Yagi antenna dimensioned for the

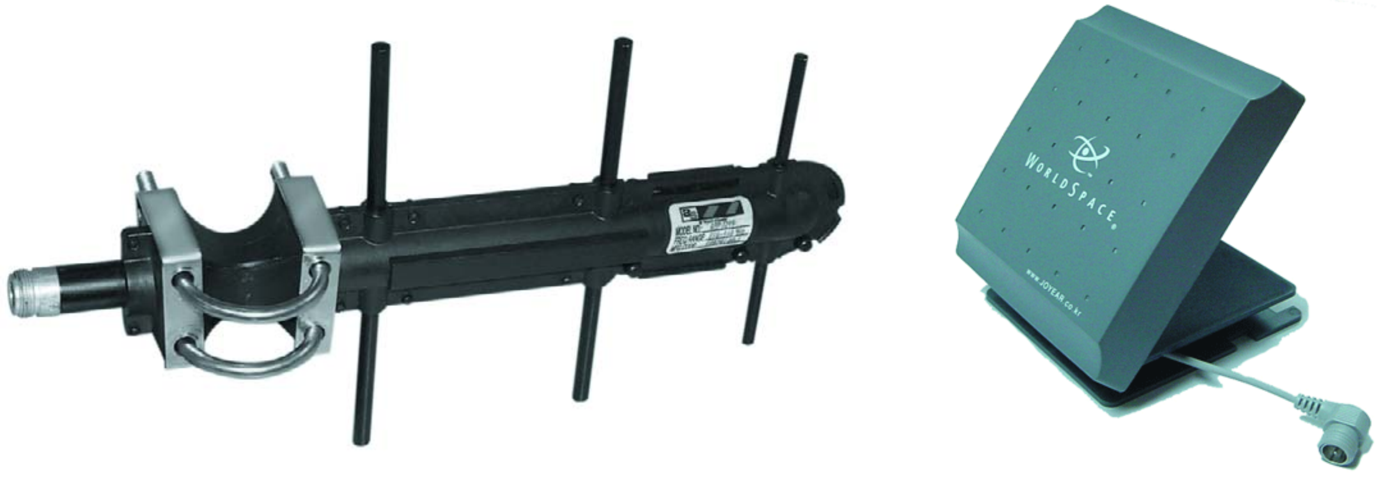

Figure 1. Yagi and patch antennas for WorldSpace Radio.

Table 2b. Some WorldSpace receivers employing the Starman chipset
Note: a complete summary can be downloaded from *www.elektor-electronics.co.uk*

Receiver	**FR-DS 100**	**JSRA-WS 0110**	**DAR-WS 2000**
Manufacturer	JVC (Japan)	JS Info (South Korea)	JS Info (South Korea)
Memories	20	10	10
Other wavebands	FM, MW, LW	none	none
Loudspeaker	Stereo, 2x 3.5 W	Mono, 0.8 W	Mono, 0.6 W
Headphones	Stereo	Stereo	Stereo
Display	1 row of 8 characters	1 row of 10 characters	1 row of 10 characters
Data port	yes	yes	yes
Special features			
Power supply	6 D cells	4 AA cells	2 C cells
Dimensions	450 x 58 x 250 mm	130 x 130 x 40 mm	157 x 139 x 25 mm
Weight	4.2 kg	0.9 kg	0.3 kg
Accessories	8 m antenna cable	3 m antenna cable mains power supply	mains power supply
Price (Euros)	€ 200	€ 190	€ 200
Website	www.jvc.com	www.joyear.co.kr	www.joyear.co.kr

1.5 GHz band and designed for fixed installation. An antenna cable to wherever the radio is situated is then also required.

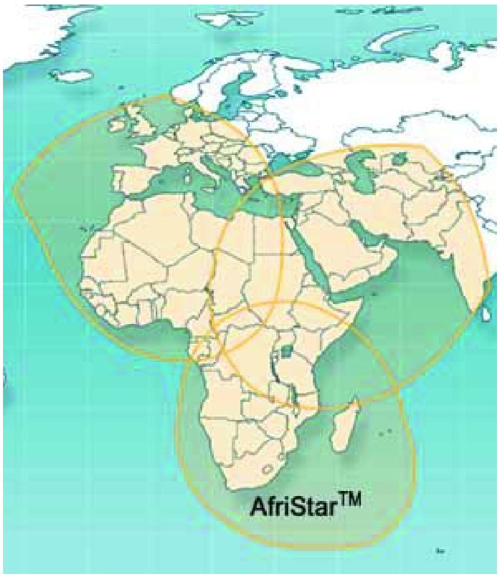

Figure 2. AfriStar's three beams.

A Yagi antenna is supplied instead of a patch antenna with the low-cost WSSR-11 receiver. This type of antenna typically has a very narrow acceptance angle and must therefore be aligned very accurately. For portable or mobile reception in Europe WorldSpace receivers with patch antennas are invariably the preferred option.

So far only a car antenna with magnetic base has been made available, even though reception is impossible if the satellite is obscured by trees or houses. It was developed by the broadcaster Hit Mix FM and costs around one hundred pounds, and is a modified Sanyo DSB-WS 1000 patch antenna. Methods are being worked on to avoid signal interruptions while the satellite is briefly obscured. One idea is to transmit a channel simultaneously live and delayed by a few (4.32 to be exact) seconds. The receiver can then reproduce the delayed channel while storing the live channel in a buffer. If the signal is interrupted, the receiver can continue to play for up to another 4.32 seconds. When reception is re-established, the receiver can return to the delayed channel and fill the buffer again from the live signal. A disadvantage of this method is that the system can only carry half as many transmissions.

Also, experiments are being carried out with terrestrial repeaters that receive the WorldSpace signal from the satellites and rebroadcast it in obscured areas. This principle of using fill-in TV transmitters is already well known.

WorldSpace Direct Media Service

The WorldSpace system is also designed for data transmission. The WorldSpace Direct Media Service

(DMS) can send up to 128 kbit/s over one broadcast channel. Of course, it is not possible to provide a fully featured Internet connection, since there is no reverse channel, but editorially-selected Internet content of some 15 websites is provided and made available in the form of regular transmissions to WorldSpace receivers. An up-to-date list of websites available using DMS can be found at www.worldspace.com/productservices/directmedia/contentlist.html.

Every WorldSpace receiver has a data port which can be connected to a PC over the USB interface via an external adaptor. An expansion card is also available for the PC which contains a complete WorldSpace receiver. An external antenna is attached directly via an F connector, and the data services can then be received. Users who also want to listen to the radio stations will not be disappointed: the audio signals can be connected to a stereo system, allowing the PC card to be used as a high quality radio.

The final part of the WorldSpace specification provides for text and small-format TV images (176 by 144 pixels at 8 to 12 frames per second) to be transmitted in a broadcast channel. Top-of-the-range receivers can reproduce these images on a suitable display without a PC.

WorldSpace radio in central europe

After AfriStar was launched Hitachi carried out initial reception experiments which revealed that good reception of WorldSpace radio was possible using the standard patch antenna not only in the target regions but much further afield. The west beam of AfriStar can be received without difficulty as far north as Scotland and southern Scandinavia (**Figure 2**). The east beam, on the other hand, reaches only as far as southern Europe and reception here is only possible using

Table 3 AfriStar channels

Note: Channels broadcast on the west beam can be received in central Europe.

BCID	Station	Programme Type	Language	West beam	South beam	East beam
543	EMA TEST	Education	various	X		
613	NGOMA	Music	English	X	X	
614	Killa Musika	Music	Arabic	X	X	X
615	Haneen	Music	Arabic	X	X	
627	WRN-1	News	English	X	X	X
628	WRN-2	News	German	X	X	X
700	BOB	Music, Modern Rock	English	X	X	X
701	Ultra Pop	Pop Music	English	X	X	X
702	24x7	Dance Music	English	X	X	X
703	Potion	Urban, Adult Contemporary Music	English	X	X	X
704	Up Country	Country Music	English	X	X	X
705	RIFF	Jazz Music	English	X	X	X
706	RITMO!	Pan African	English	X	X	X
707	Maestro	Classical Music	English	X	X	X
750	ALC	News / Information	English	X	X	X
800	Egypt-1	Music, News	Arabic, English, regional French	X	X	X
801	Egypt-2	Music, News	Arabic, English, regional French	X	X	X
804	RadioVoyager	Adult, Contemporary Music	English	X	X	X
805	KISS 100	Music	English		X	X
806	East FM	Music	English, Hindi, Urdu	X	X	X
H807	KBC	Full Service	Swahili	X	X	X
810	Radio &TV Senegal	Full Service	French	X	X	-
812	WALF FM	Full Service	French	X	-	
814	CNN International	News	English	X	X	X
817	Medi-1	Full Service	English	X	X	X
818	Bloomberg-En	News	English	X	X	X
819	Bloomberg-Fr	News	French	X	X	X
820	Bloomberg-Sp	News	Spanish	X	X	X
821	Bloomberg-It	News	Italian	X	X	X
823	Radio One	Full Service	English	X	X	X
824	Capital Radio	Music	English, Turkish	X	X	X
825	RMC-MO	News	Arabic, French	-	X	-
829	REE	Full Service	Spanish	-	X	-
830	MBC	Full Service	Arabic	-	X	
831	RBC	Music	Hindi	X	-	X
832	Canal EF	Education	French	X	X	X
833	CONGO-BZV	Full Service	French	X	X	
834	Europe-1	News	French	X		
835	KIE	Education	English		X	
837	HITMIX FM	Music	German, English	X	X	
838	CAPITAL FM	Pop Music	English	X		
900	KAYA - FM	Full Service	English	X	X	X
902	RFI-2	News, Music	French, English	-	-	X
903	RFI-1	News	French	-	X	-
904	BBC-AfrW	News	English	-	X	-
905	BBC-AfrS	News	English	-	-	X
906	BBC-AfrE	News	English	-	X	-
907	BBC-Arab	News	Arabic	-	X	-
908	AIR	Full Service	Hindi, Urdu	X	-	-
909	Lusofonia	Full Service	Portugese		X	
942	Jacaranda	Music	English		X	
947	Highveld	Music	English		X	
999	Ch Islam	Education	English	X	X	
1515	Marine T	News	various	X		

a directional antenna, such as a Yagi. The south beam of AfriStar can of course not be received in Europe.

WorldSpace radio programmes

During the construction of the WorldSpace system there were many changes to the satellites' channel allocations. Initially many programmes were produced by WorldSpace itself, in order to provide an incentive for people to buy receivers. Once it was demonstrated that the efficiency of the system was so good that reception was possible well outside the planned target areas, it became possible to find more and more programme providers who were prepared to rent a WorldSpace broadcast channel. Today, alongside internally produced education and light entertainment programming, there are many well-known radio stations on WorldSpace: BBC, CNN International and Radio France International (RFI) to name just a few.

Prospects

WorldSpace is the first satellite radio system available worldwide. The satellite infrastructure is now in place with AfriStar, AsiaStar and AmeriStar, and the system offers fixed and mobile reception. The number of firms producing WorldSpace receivers is growing rapidly. The prices are still subsidised by the WorldSpace organisation, but will fall as take-up spreads and quantities grow. Work is in progress on in-car mobile receivers: where there is line of sight to the satellite there is clearly no problem; where the satellite is obscured, between buildings in a city for example, fill-in transmitters must perhaps be resorted to.

All in all WorldSpace has a good chance of establishing itself worldwide — in contrast to national projects such as German Digital Satellite Radio (DSR), abandoned after just a few years. It helps that the system is aimed at regions not well supplied with radio stations, rather than trying to introduce a modern transmission system into areas already over-supplied with established stations. Nevertheless, the construction of a EuroStar satellite to extend WorldSpace signal availability to the whole of Europe is already being considered and is the subject of preliminary contracts with satellite manufacturers.

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References:

- ST Microelectronics STA001 and STA002 datasheets (at www.stmicro.com)
- Micronas DRD3515 and MAS3506 datasheets (at www.micronas.com)

Information on the World Wide Web

(see also under 'HyperLinks' at
www.elektor-electronics.co.uk)
www.worldspace.com
www.worldspace.org
www.stmicro.com
www.micronas.com
www.alcatel.com/telecom/space
www.worldspaceradios.co.uk
www.orbitica.com
www.hitfm.de/worldspace/main.html
www.hit-fm.com